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by degrees" and finally "swallowing up," yet shows a high appreciation of English rule in India ——Dr. Arthur Krause has returned to Germany from a journey to the Chukchi Peninsula and Alaska. ——The ordnance survey of Scotland is completed. ——Easter Island is now almost entirely owned by the "Maison Brander" of Tahiti. It is a large grazing farm, and there are now about 10,000 sheep and 400 cattle upon it. Half wild poultry are abundant, and potatoes, bananas, and plantains grow readily. The natives left are only about 150 in number, as 500 were shipped to Tahiti about eight years ago, and the missionaries removed 300. The few left are thieves, without any religion.—— The extinct crater Te Kama Kao contains a lake covered with a carpet of decayed vegetation, and with no bottom at 50 fathoms in the centre.

GEOLOGY AND PALÆONTOLOGY.

PHYSICAL AND GEOLOGICAL CHARACTER OF THE SEA-BOTTOM UNDER THE GULF STREAM.—The longest and most interesting paper read at the late meeting of the National Academy of Sciences, was by Professor A. E. Verrill, discussing the physical and geological character of the sea-bottom off our coast, especially beneath the Gulf stream.

The paper embodied the general results of observations covering a period of eleven years, including dredgings by the United States Fish Commission, taken from over 2000 stations between Chesapeake bay and Labrador, and out as far as 150 to 200 miles off shore. Professor Verrill and his associates of the commission found in these observations that from the shore to a point about sixty miles out the water is inhabited by animals representing arctic life, similar to those found off the coast of Greenland, Spitzbergen and Siberia. Beyond this lies a warm belt of water which is inhabited by tropical or sub-tropical animals. This warm belt varies with the shore-line of the coast, and while its eastern edge is within sixty miles of Nantucket and Martha's Vineyard, it is much further off from the coast of Massachusetts and Maine; as what is known as the Gulf of Maine is a cold body of water, outside of which lies the warm belt. This warm belt is about twenty-five miles in width. In this the temperature from a depth of 65 fathoms out to the limits where the soundings show a depth of 1000 fathoms, is from 46° to 52° Fahrenheit near the surface, decreasing in temperature in the lower soundings, until at 700 fathoms it is 39°. In the cold belt the temperature of the water ranges from 35° to 45° in August below the surface water, which is in the autumn warmer than that underneath. The temperature at 40 fathoms in the cold belt averages from 35° to 37°. In the warm belt the temperature at 65 fathoms is 46°; at 100 fathoms, 50° to 52°; at 200 fathoms, 48°; at 300, 40°; and at 700, 39°. As a result of the soundings, measurement of temperatures, etc., it was discovered that an error exists in our maps and charts in placing the warm belt, or Gulf stream, too far from the shore by thirty or forty miles. It was also found that the soundings even on the coast survey charts were inaccurate by hundreds of fathoms in many instances, which are now, however, corrected by the coast survey soundings made during the past summer. The general accepted theory has been that the 100-fathom line marked the line of the Gulf stream, but this was found to be incorrect, as the line would be more nearly correct if placed at 65 or 70 fathoms line. The charts are also incorrect in that they make out a difference in the line of the Gulf stream in summer and in winter. Professor Verrill held that there was no variation in the body of the stream, though there is in the surface water an apparent variation, due to the sweeping in of the warm surface water in the summer and the diffusion of the cold surface water over the stream from the shore during the cold months. The proof of his theory is the fact that the sub-tropical life exists in the Gulf stream in winter as well as in summer, while the character of the inhabitants of the cold belt remains unchanged the year through, and the line of separation between the two kinds of life is well and distinctly marked on the bottom. If there was a variation in the bottom of the stream there would be death to the sub-tropical life of the warm belt.

In the portion of the warm belt south of the New England coast, from 70 to 120 miles from the coast, there was discovered, in 1880, the most valuable ground for the sub-tropical animal life, as prolific in invertebrate animals as any in the world. From this ground the dredges have taken and brought to the surface 800 species of animals, over one-third of which were entirely new and unknown to science, including 17 kinds of fishes, 270 of mollusks, and 90 of crustacea. The recent observations of the Fish Commission have been made in a warm belt extending about 160 miles from the north-east to the south-west, and about 20 miles in width. Over 130 dredgings were made in this belt at a depth of 100 fathoms. At about the 100 fathom point the formation of the sea bottom is peculiar in many respects. To this point there is a gradual descent from the shore. Then there is a precipitous descent to soundings of 1000 fathoms or more, the sudden precipitous descent corresponding to about the height of Mount Washington along the territory that has been explored. The warm belt seems to extend down this precipice only to a depth of about 125 fathoms, judging from the evidence of life brought up in the dredges as well as the thermometrical records. A trawl had brought to the surface in several instances a ton of animal life, which included crabs, shrimps, starfish, and shells of various kinds, among them shells which had hitherto been found only on the shores of the West Indies, but which are now known to be inhabitants of the warm belt of water running along the

Atlantic coast. The surface inhabitants are also tropical in their nature, as is shown by the capture of argonautas, Portuguese men-of-war, varieties of the jelly-fish, and pteropods in large quantities. A peculiarity in the weather was noticed by the people engaged in dredging, for while it was pleasant out on the warm belt, they had found, on their return to the shore, that a storm had been raging, which had caused their associates on shore anxiety as to the safety of their steamer, the *Fish Hawk*, and the people on board.

The quality and quantity of the light in the depths had not yet been ascertained, but some marked peculiarities have been noticed. Many of the crabs and other animals caught have been found to have the eyes very largely developed. Other animals, which live at greater depths, have been found to be without eyes, presumably a useless organ in the great depths. Another peculiarity observed about the animals found at great depths is that their color is either red or an orange yellow, this being the case with the corals, anemones, fish, and such animals as are exposed to attack from voracious enemies. It is therefore inferred that the color is a mode of defence, in that it renders the animal invisible in the greenish-blue water, and the similarly colored rays of light which can only reach to those depths, and so render a red coat a means for its wearer to keep out of sight of its enemies. The bottom of the Gulf stream is very peculiar. That of the Arctic belt is a coarse gravel or sand. That of the great depths a sticky mud. Under the Gulf stream the bottom is of sand of so fine a grain that the grains can only be distinguished from one another under the microscope. This packs together so compactly that the sailors who find it clinging to the sounding leads call it mud. Yet it is the finest grade of sand, very cohesive in its nature. Mixed with it in great quantity are masses of the most minute shells. The two seem to form a bed as level and hard as any floor, and, judging from the results of dredging, this floor is carpeted thickly and densely with masses of vegetable and animal life. Boulders are occasionally found on this bottom, and these, the professor thought, had dropped from cakes of ice that had floated out from the shore. There are also brought out by the dredges occasionally a different form of rock, which seems to be indigenous to the bottom and filled with fossil shells, many of which are exactly like the shells now found on the bottoms. These rocks, he thought, might possibly date back to the Pliocene age, but possibly only to the Post-pliocene. Their appearance in the dredges he presumed to be due to the fact that they had been loosened from their beds by the burrowing fishes and animals and then caught up by the dredges.

In connection with the character of these fossil rocks, he had noticed the absence of all vertebrate fossils. The dredges, too, had never brought up any evidence of the existence of dead vertebrates, though the water swarmed with myriads of sharks, dolphins, and other vertebrates, nor had any evidence of the existence of man been brought up in these dredges, and nothing of consequence of man's work except an India-rubber doll, that had been dropped overboard from some vessel. Yet the territory dredged was in the track of the European vessels, and where ships have gone down and lives been lost, but everything of this character is destroyed by the voracious animal life of the tract. These facts led him to doubt the negative evidence in geology, and the absence of vertebrates among the early fossil remains found does not lead him to conclude that the mammals did not exist at that time, as their remains might have been destroyed by the animals that have been found in the rocks, as are all evidences of vertebrates in the tract they had been dredging, although it is well known that such animals exist in myriads in the waters above. The presence of broken shells in large quantities on the bottom, he said, was due to the fact that carnivorous crabs and other animals eat the bivalves and univalves alike, cracking up and throwing away the shells. He also stated that the bivalves were food for the cod, which digests out the meat and then spits out the shells. —*Scientific American.*

THE TERTIARY DEPOSITS OF THE ATLANTIC SLOPE.—The last volume of the proceedings of the Philadelphia Academy of Natural Sciences contains a valuable paper by Professor A. Heilprin, upon the relative ages and classification of the Post-eocene tertiary deposits of the Atlantic Slope, particularly of Maryland, Virginia and North and South Carolina. These were considered by Mr. Conrad to be of one formation, which he usually regarded as Miocene, but at other times thought to be the equivalent of the British Crag, now usually believed to be Pliocene. Mr. Conrad concluded that his Miocene strata represented "one contemporaneous sea-bottom," although he noted that the strata of North Carolina contained a greater proportion of recent to extinct forms than those of Virginia or Maryland. Lyell noted the same fact, but did not institute a comparison. Professor Heilprin gives full faunal lists of the mollusca, from which he obtains the following results; The deposits of South Carolina contain 35 to 38 per cent. of recent forms, those of North Carolina 26 per cent., those of Virginia 11 per cent., and those of Maryland 12 per cent. The Maryland deposits may be divided into a newer and an older, the former of which contains 16, the latter 4 per cent. of recent species. From these data Professor Heilprin concludes that the North and South Carolina deposits represent approximately the same geological horizon; and that the Virginia deposits are lower and older and coincide with the upper deposits of Maryland. The Maryland deposits almost certainly represent two faunal horizons, and the same is probably the case with those of Virginia. The Maryland and Virginia faunæ, from their small percentage of living forms, are doubtless Miocene, but these of North and South Carolina are more difficult to pronounce upon, yet, on the whole, Professor Heilprin is of opinion that they should be classed as upper Miocene rather than as Pliocene.

The Atlantic Miocene may therefore be considered to form three groups: First, the Upper Atlantic Miocene or Carolinian, of the North and South Carolina deposits; second, the Middle Atlantic Miocene or Virginian, and the newer group of Maryland; and third, the older group of Maryland, and possibly the lower Miocene beds of Virginia.

A NEW FOSSIL SIRENIAN.—At a recent meeting of the Philadelphia Academy, Professor Cope read a paper on Dioplotherium, a a new genus of Sirenia from the Miocene beds of South Carolina. The form is allied to Halicore and Halitherium, but differs from both in the possession of two incisive tusks in each premaxillary bone. The anterior tusk is large and compressed towards the apex; the second is not much smaller than the first. The premaxillary bone preserved indicates an animal not smaller than the dugong. It was named *Dioplotherium manigaulti* in honor of Mr. Gabriel Manigault, director of the Charleston Museum.

THE GEOLOGICAL STRUCTURE OF SOUTH AMERICA.—Professor Orville Derby, director of the Geological Survey of Brazil, has given an instructive general view of the geology of Brazil and its relations to that of the southern continent.[1] He first directs attention to the two primitive islands, round which the continent grew. These are the archæan regions of Eastern Brazil and of Guiana, which now consist chiefly of mountain ranges. Between these the Amazon region was represented by two gulfs, the one opening to the east and the other to the west, and connected by a wide strait at the point of closest approach of the *terræ firmæ* above mentioned. These islands were, according to Professor Hartt, Professor Derby's predecessor, elevated during the early part of the Silurian period. Their materials represent three periods, the Laurentian, Huronian and Lower Silurian.

In the Palæozoic sea were deposited successively formations of Upper Silurian, Devonian and Carboniferous ages. They are all well represented by fossils, of which many are identical with species of corresponding periods of North America. The Upper Silurian is about 1000 feet in thickness, the Devonian has not over 600, and the Carboniferous 2000 feet, according to Mr. H. H. Smith of the survey. They are exhibited on both sides of the Amazon valley, and are best seen in the cuts made by the numerous tributaries of the great river. The Devonian is divided into three subdivisions, two of which correspond to the Corniferous and Hamilton of North America respectively. The Carboniferous represents the Coal measures, and is very rich in invertebrate fossils, more than one hundred species having been obtained up to 1879. More than half the species are identical with those of the Western United States. During the Paleozic periods enormous deposits were laid down in the Andean region.

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[1] Proceedings American Philosoph. Society, 1879, p. 155.

The Cretaceous beds occur chiefly on the eastern sides of the primitive archean islands. North of the Amazon they fill the basins of Pernambuco and Sergipe, and south of it, one between Salinas and Bragança. In the Amazon valley they are certainly known from the flanks of the eruptive mountains of Ereré on the north side of the lower Amazons, and according to Chandless, in an extensive area on the river Purus in the middle or Solemoëns drainage area of the Amazon, on the southern side. At Ereré they are only three hundred feet thick. Towards the close of the Cretaceous period the great ranges and plateaux of the Andes were elevated, closing the mouth of the western gulf, and converting the Amazon valley into a Mediterranean sea, with probable outlets to the north and south, as well as to the east.

The lacustrine beds which cover the Amazon valley and even the paleozoic lands on its borders, are of various character, and have not been thoroughly explored. Those of the lower Amazon are tertiary, and are 1000 feet thick, and contain no fossils. Those of the Upper or Marañon basin, as observed at Pebas Equador, are of Laramie or Upper Cretaceous age, and contain the invertebrate genera characteristic of the Bear River group of North America. The immediate valley of the Amazon is filled by a fluviatile deposit, the "varzea," which undergoes constant changes, due to the movements of the river and its tributaries.

Plutonic phenomena were especially frequent during the paleozoic periods. This is attested by numerous masses of diorite and trap which traverse those beds, and by the elevation of the mountains of Ereré, in the lower Amazonas, already mentioned.

GEOLOGICAL NEWS.—In the November number of the *American Journal of Science*, J. W. Dawson notes recent discoveries in the Devonian Flora of the United States, discusses the nature and affinities of Psilophyton, a lycopodiaceous genus, and mentions the occurrence of five species of conifers in the Middle Devonian.

In the same number W. Earl Hidden contributes notes on various North Carolina minerals, and Professor Silliman writes upon the Martite of the Cerro do Mercado, or Iron mountain, of Durango, Mexico. This hill, a mile long, a third of a mile wide, and four to six hundred feet high, rises abruptly from the plain on which the city of Durango stands, and contains one or more immense, nearly vertical beds of specular iron ore, masses of which are scattered all over the surface, and have given rise to the idea that the entire mountain is formed of iron. The indications are that the deposit extends far beneath the plain from which it projects. The near approach of the railway system of Mexico promises to give this mass of ore a commercial importance.

——The previously noticed paper upon Earth Movements, by Professor J. Milne, of Tokio, Japan, appears in the *Geological Magazine* for November, and the same number contains the following: Remarks on some remains of plants, Foraminifera and Annelida, in the the Silurian rocks of Central Wales, by W. Keeping: six new plants, and *Myrianites lapworthii*, an annelid, are described.——The Rev. A. Irving continues his notes on the Dyassic and Triassic rocks, and Professor E. Hull answers some of his previous statements.——The evidence of the angular drift in favor of a great post-glacial flood is continued by Mr. H. H. Howorth, who asserts that the marine drift will lend him further support.

——The December issue of the *Geological Magazine* contains: Notes on *Oreaster bulbiferus*, from the Upper Chalk of Kent, by P. Herbert Carpenter.——A notice, the third in order, of fish remains from the Blackband Ironstone of Borough Lee, near Edinburgh, by Dr. R. H. Traquair. Four selachians, a dipnoan and three ganoids, are described.——The fallacy of the theory of the "Permanence of Continents," by J. S. Gardner. Mr. Gardner maintains that Mr. Wallace's supposition that the chalk is a shallow water deposit, is untenable. In it no allowance was made for the loss of iron from the body of the chalk by crystallization, nor for the segregation of the silica into flints. The absence of Globigerina and almost all the cretaceous fossils from the decomposed coral mud of Oahu, shows that they were not deposited under the same conditions. It is also argued that oceanic islands could not have received their peculiar land-shells by an oceanic route.——Mr. H. H. Howorth continues his voluminous argument upon the "Traces of a Great Post-glacial Flood."——C. Lapworth writes upon the identification of certain beds near Birmingham, England, hitherto supposed to be Upper Silurian, with the Cambrian era.——W. Dames gives some new facts upon the skull ot *Archæopteryx*. The opening called nasal, by Marsh, is preceded by a third opening, entirely surrounded by the premaxillary, and this opening is affirmed to be the true nasal aperture. The clearing away of the matrix from the skull examined (that in the Royal Mineralogical Museum of Prussia) showed the dentition, and proved that Marsh was in error in considering that the teeth were limited to the premaxillary, as they occur at least upon the anterior portion of the maxillary. Mr. Dames also states that appearances are in favor of a separate alveolus for each tooth, rather than of a groove, as stated by Marsh. The shoulder-girdle is not yet cleared from the matrix, but appears to be different from anything known elsewhere. At a late meeting of the Geological Society of London Dr. R. Häusler communicated the results of his researches on the arenaceous foraminifera of the upper Jura of the Aargau—about sixty species are determined.——Mr. J. E. Taylor gives proofs of the occurrence, along the shores of Norfolk and Suffolk, of an extensive sub-marine peat-bed, full of bones and teeth of elephant, ox, deer, etc. This part was nine feet thick in the course of the new channel cut for the Orwell river. Fishermen frequently bring up lumps of peat. Trunks of trees stand at Helm Searf, Norfolk. This confirms the theory of the marshy conditions prevalent previous to the submergence that converted Britain into an island. ——Professor T. R. Jones, in the fifteenth of a series of articles upon the Palæozoic bivalved Entomostraca, in the *Annals and Magazine of Natural History*, describes a carboniferous *Primitia*. In the same magazine (Sept. 1882), Dr. J. C. Hinde describes several fossil Calcispongiæ.

MINERALOGY.[1]

ANALYSES OF SOME VIRGINIA MINERALS.—Professor J. W. Mallet has communicated to the *Chemical News* some notes of work done by students at the University of Virginia upon American minerals.

W. T. Page has analyzed an allanite of unusual chemical composition from Bedford county, Va. It occurred as a compact black mass, with pitch-like luster, spec. grav. 4.32, and the unusual hardness of nearly 7. Its composition is as follows:

SiO_2	Al_2O_3	Ce_2O_3	Di_2O_3	La_2O_3	Fe_2O_3	FeO	MnO
26.70	6.34	33.76	16.34	1.03	3.21	4.76	trace

BeO	MgO	CaO	Na_2O	K_2O	H_2O
0.52	0.54	2.80	0.49	0.55	1.99

The very large proportion of the cerium metals present (over 50 per cent., or double the usual amount), and the large excess of didymium over lanthanum are peculiarities which may justify its being considered as a new variety of allanite.

B. E. Sloan has reëxamined the helvite of Amelia C. H., Va., already refered to in the NATURALIST. Having at his command a larger amount of pure material than Mr. Haines possessed, a new analysis was made which conforms more closely to the formula adopted by Rammelsberg. The analysis gave:

SiO_2	BeO	MnO	FeO	Al_2O_3	Mn	S
31.42	10.97	40.56	2.99	0.36	8.59	4.9 = 99.88.

W. H. Seaman analyzed a pale hyacinth-red garnet from the same locality, which, like the other recorded analyses of the same variety of garnet—spessartite, or aluminum-manganese garnet, shows an anomalous deficiency of triad as compared with dyad metals.

R. N. Musgrave has analyzed the albite from the same locality, the analysis closely corresponding to the tri-silicate formula $Na\ Al\ Si_3\ O_8$. The albite here occurs as a delicately aggregated mass of colorless flattened crystals, forming beautiful specimens.

A supposed metallic meteorite from Augusta county—a pear-

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[1] Edited by Professor H. CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.